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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference L2124 PCT	FOR FURTHER ACTION	See Form PCT/IPEA/416
International application No. PCT/US2004/025769	International filing date (day/month/year) 10.08.2004	Priority date (day/month/year) 25.09.2003
International Patent Classification (IPC) or national classification and IPC C08J9/00, C08J5/18		
Applicant 3M INNOVATIVE PROPERTIES COMPANY et al.		
<p>1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.</p> <p>2. This REPORT consists of a total of 5 sheets, including this cover sheet.</p> <p>3. This report is also accompanied by ANNEXES, comprising:</p> <p>a. <input checked="" type="checkbox"/> sent to the applicant and to the International Bureau a total of 2 sheets, as follows:</p> <p><input type="checkbox"/> sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).</p> <p><input checked="" type="checkbox"/> sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.</p> <p>b. <input type="checkbox"/> (sent to the International Bureau only) a total of (Indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).</p>		
<p>4. This report contains indications relating to the following items:</p> <p><input checked="" type="checkbox"/> Box No. I Basis of the opinion</p> <p><input type="checkbox"/> Box No. II Priority</p> <p><input type="checkbox"/> Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability</p> <p><input type="checkbox"/> Box No. IV Lack of unity of invention</p> <p><input checked="" type="checkbox"/> Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement</p> <p><input type="checkbox"/> Box No. VI Certain documents cited</p> <p><input type="checkbox"/> Box No. VII Certain defects in the international application</p> <p><input type="checkbox"/> Box No. VIII Certain observations on the international application</p>		
Date of submission of the demand 25.07.2005	Date of completion of this report 19.12.2005	
Name and mailing address of the international preliminary examining authority:  European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	Authorized Officer Otegui Rebollo, J Telephone No. +49 89 2399-8670	



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/US2004/025769

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

Description, Pages

1-24

as originally filed

Claims, Numbers

1-10

received on 06.12.2005 with letter of 06.12.2005

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☒ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☒ the claims, Nos. 1,9,10
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

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Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	
	No: Claims	1-10
Inventive step (IS)	Yes: Claims	
	No: Claims	1-10
Industrial applicability (IA)	Yes: Claims	1-10
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item I

Basis of the report

The subject-matter of claims 1, 9 and 10 appears to offend Article 34(2)(b) PCT in that the features introduced in said claims having been taken from passages of the description without taking with them the features attached to them, thus constituting unallowable generalizations of the actual features disclosed in the application as originally filed. See for instance on page 4, cited in support of the amendments: "As will be readily understood from the following detailed description, the present invention makes it possible to provide a heat conductive sheet which is economical and easy to produce, which requires no use of a solvent for preparation of the sheet-forming composition, which has **excellent heat conductivity**, which simultaneously satisfies the conditions of flexibility and adhesive properties, and **which can be adhered onto parts with a minimal load**. In particular, because the heat conductive sheet of the invention is a foam body, it is **highly flexible and exhibits high compressibility under minimal loads**". Or page on 1: "Yet another property required of heat conductive sheets is the ability **to adhere to parts under minimal load** in order to avoid excessive dynamic load on the parts." Emphasis added.

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

The following documents are referred to in this report:

- D1 : EP 0 736 645 A (ROEHM GMBH) 9 October 1996 (1996-10-09)
- D2 : DE 43 13 715 A (ROEHM GMBH) 3 November 1994 (1994-11-03)
- D3 : US 4 183 991 A (SMILEY LEONARD H ET AL) 15 January 1980 (1980-01-15)
- D4 : US 4 816 492 A (SCHILLER JOST H ET AL) 28 March 1989 (1989-03-28)

1. The subject-matter of claims 1 to 10 of the present application appears to be novelty anticipated (Article 33(2) PCT) by the acrylic cast resin foaming compositions comprising heat conductive fillers, such as aluminium hydroxide, and heat conductive foam sheets prepared therefrom disclosed in documents D1 to D4 (see passages cited in the search

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(SEPARATE SHEET)**

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report). Concerning the subject-matter of claims 2 and 7 of the application, applicants' attention is drawn to the fact that when using unusual parameters (ie those not disclosed in the available prior art) in the definition of the invention, the onus of proof usually lies with them. Furthermore, although documents D1 to D4 do not recite expressis verbis the use of the foam sheets therein described for use as heat conductive sheets, it is pointed out that: 1) the sheets of D1 comprise well-known heat conductive fillers such as aluminium hydroxide, which may be used as outer wall covering elements (see claim 5), in which use heat conductivity is usually implicitly taken into account; 2) in D2 good heat conductive fillers such as metals and alloys may be used as fillers (see in particular page 3, lines 11 to 14), which clearly indicates the skilled person that the foam sheets described therein have good heat conductive properties; 3) in D3 also good heat conductive fillers such as metallic flakes or graphite may be use in preparing the foam sheets (see for instance column 3, lines 57 to 62, and column 4, lines 11 to 16); 4) although D4 discloses foam sheets with insulating properties, even insulating materials conduct some heat. Note that in claim 1 of the application the term "heat conductive" is not precisely defined (Article 6 PCT), and therefore it may not constitute a differing feature of the invention as no novelty or inventive step may be based on unclear features.

PCT/US2004/025769
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 Our Ref.: L2124 PCT

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06. Dez. 2005

CLAIMS

1. ~~A heat-polymerizable, foam sheet-forming composition used to form heat-conductive foam sheets~~ ^{heat-conductive} comprising, in combination, the following components:
- a heat-polymerizable binder component comprising at least one (meth)acrylic monomer or its partial polymer,
 - a heat conductive filler,
 - a heat polymerization initiator for said binder component, and

a foaming agent;

wherein the foam sheet is a compressible, adhesive foam sheet.

2. ^{heat-conductive} A foam sheet-forming composition according to claim 1, in which said (meth)acrylic monomer comprises a (meth)acrylic monomer having an alkyl group of no more than 20 carbons.

3. ^{heat-conductive} A foam sheet-forming composition according to claim 1 or 2, further comprising an acrylic polymer which is composed mainly of an acrylic acid ester wherein the ester portion has 1 to 20 carbons, which has a glass transition temperature of no higher than 20°C and a weight-average molecular weight of from 500 to 100,000, and which has substantially no functional groups.

4. ^{heat-conductive} A foam sheet-forming composition according to any one of claims 1 to 3, in which said foaming agent comprises an inorganic foaming agent, an organic foaming agent and/or thermal expanding microcapsules.

5. ^{heat-conductive} A foam sheet-forming composition according to any one of claims 1 to 4, in which said foaming agent is used in an amount of 0.1 to 20 parts by weight with respect to 100 parts by weight of the (meth)acrylic monomer.

6. ^{heat-conductive} A heat conductive foam sheet comprising a heat polymerized molded article made from a foam sheet-forming composition described in any one of claims 1 to 5

²
1. A heat conductive foam sheet according to claim ¹6, in which said heat-polymerizable binder component further comprises a cross-linking agent, and the acrylic polymer produced as a binder upon polymerization and cross-linking of said binder component is a cross-linked product so that the resulting product has a weight-average molecular weight of less than 200,000 in the polymer chain thereof, a shearing storage modulus (G') of 1.0×10^3 to 1.0×10^5 Pa at the frequency of 1 Hz and 20°C, and optionally a loss tangent ($\tan \delta$) of 0.2 to 0.8.

⁷
2. A heat conductive foam sheet according to claim ^{any one of 1106} 1, in which the heat conductivity is 2 W/mK or greater.

⁸
3. A heat conductive foam sheet according to any one of claims ¹¹⁰⁷ 1 to 2, in which the void volume is 5 to 50 vol%.

~~4. A process for producing a heat conductive foam sheet, comprising:
preparing a foam sheet-forming composition described in any one of claims 1 to 3,
molding said composition into a sheet, and
heating said composition either during or after the sheet-molding step to simultaneously accomplish reactions for heat polymerization of said binder component and foaming of said composition.~~

11. A process for producing a heat conductive foam sheet according to claim 10, in which sheet-molding is carried out by calender molding or press molding either in the presence or in the absence of a liner.

~~12. A process for producing a heat conductive foam sheet according to claim 10 or 11,
in which heating is carried out at a temperature of 50 to 200°C.~~

9. Use of the heat conductive foam sheet according to any one of claims 1 to 8, to adhere a heat radiating part to a heat generating part.

10. The use according to claim 9, wherein the heat generating part is an electronic or electrical device.